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Variation in access to community rehabilitation services and length of stay in hospital following a hip fracture: a cross-sectional study

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Objectives: To assess variation in access to community rehabilitation services for patients sustaining a hip fracture, and whether this affects length of stay in hospital.

Design: Cross-sectional study using patient-level data from Hospital Episode Statistics (HES) and organisational data.

Setting: A regional health care economy in South West England.

Population: 1,376 hip fracture patients treated in four acute NHS hospital trusts within seven former Primary Care Trusts (PCTs) between 1st April 2011 and 29th February 2012.

Main outcomes: Hospital access to community rehabilitation beds and home-based rehabilitation services, reported in an organisational survey. Rates of patients transferred from acute hospitals to community rehabilitation hospitals across seven PCTs. Average length of stay in the acute hospital and the NHS ("super-spell"), both adjusted using log-linear regression for patients' age, sex, comorbidity, socioeconomic deprivation and rural habitation.

Results: The percentage of patients transferred to a community rehabilitation hospital varied from 2.1% to 54.7% across the PCTs. Very low transfer rates (<5%) occurred in localities with poor access to community rehabilitation beds, whilst the highest transfer rate (54.7%) was in a PCT lacking a home-based rehabilitation service. High transfer rates (> 40%) were associated with shorter acute spells, but longer NHS super-spells (adjusted difference 3.4 days, 95% CI 0.6 to 6.7 days, p=0.02). Medium-level transfer rates (20-40%) corresponded to a shorter average acute stay (adjusted difference 4.3 days, 95% CI 2.8 to 5.6 days, p<0.001), but no excess in NHS super-spell (adjusted difference 0.8 days, 95% CI -1.3 to 3.1 days, p=0.5).

Conclusion: Within one regional health care economy, there was wide variation in the availability and use of community rehabilitation services for patients sustaining a hip fracture. Such variation appears to be inefficient as well as inequitable, with reliance on bed-based services increasing length of stay in the NHS.

Study strengths and limitations

- This study is the first to combine data from acute hospitals and community rehabilitation hospitals (CRHs) to examine different institutional arrangements for providing rehabilitation care within one regional health care economy.
- The comprehensiveness of the Hospital Episode Statistics (HES) allowed us to match admissions of the same patient to acute and community rehabilitation beds.
- Our study relates to activity in one regional health care economy in South West England and may not be generalisable across the country.
- The HES database does not capture admissions to private hospitals. However, in England, almost all hip fractures are expected to pass through NHS care. Our orthogeriatrician survey did not identify even occasional use of private residential rehabilitation services.
- Each of the acute hospitals had access to a small number of social care funded rehabilitation beds that are not captured within HES. This could lead to a slight underestimate of use of CRH beds, but is unlikely to bias estimates of the influence of CRH transfers on length of stay (LOS).
- Around 10% of patients who were coded as being transferred from the acute hospital to another NHS hospital had a missing consecutive record. However, sensitivity analyses indicate that the conclusions about the relationship between CRH use and acute and super-spell LOS remain unaltered.
- Finally, the HES database does not contain information on some potential confounders such as pre-fracture mobility. Further, we used the validated Charlson comorbidity index to adjust for individual patient comorbidity, according to which 40% of our study population were deemed free of comorbidity, which also raises the possibility of residual confounding.

What is already known on this topic

- Hip fractures are common among the frail elderly and account for significant expenditure in the NHS
- Hospital length of stay after hip fracture varies widely, but can be shortened by services providing ongoing rehabilitation either at home or within a community rehabilitation hospital.

What this paper adds

- In a region covered by seven English Primary Care Trusts, the rate of patient transfer from four acute NHS trusts to community rehabilitation hospitals following hip fracture ranged from 2.1% to 54.7% of patients.
- The highest rate of institutional transfers occurred in a PCT without home-based rehabilitation services.
- High transfer rates were associated with long NHS super-spells, whilst very low transfer rates were associated with long acute hospital length of stay. Medium transfer rates appeared to be the most time efficient.

Introduction

An important element of ensuring a safe hospital discharge is the provision of appropriate services to support individuals in the community, including ongoing rehabilitation when indicated (1). When provided early, such services can reduce hospital length of stay; although some frailer patients may benefit from extended inpatient rehabilitation to achieve a discharge home. However, the 2012 National Audit of Intermediate Care highlighted wide variation in service provision (2).

Around 60,000 older adults fracture a hip each year in England (3). Such fractures represent a major trauma for individuals and a significant societal burden, both through direct medical costs (UK estimated £1.8billion in 2000), and important social sequelae (4). Since its launch in 2007, the National Hip Fracture Database (NHFD) supported by the 'Blue Book', has highlighted the importance of hip fracture care, including geriatrician-led multidisciplinary rehabilitation (5). In 2012, the National Institute for Clinical Excellence (NICE) issued specific guidance (CMG46) on commissioning high-quality hip fracture care for up to six weeks following hospital discharge (6).

The 2013 NHFD report revealed variation in average hospital length of stay after a hip fracture, as well as variation in the total length of stay in National Health Service (NHS) institutions ("super-spell"), which includes time in community rehabilitation hospitals. In England, the overall mean super-spell length of stay was 22 days, but ranged from 12.9 to 33.5 days between hospitals, nearly a three-fold variation (3). The report highlighted difficulties in identifying the causes of such variation given the complex and heterogeneous provision of post-acute hip fracture care, which can vary by individual, hospital, health care trust and region.

We aimed to assess variation in access to and use of community rehabilitation services within a defined region in England. We then determined the relationship between use of community rehabilitation services and length of stay following a hip fracture, in order to evaluate the efficiency of different institutional arrangements for providing rehabilitation care within the NHS.

Methods

Study population

We studied four NHS acute hospital trusts which provide acute hip fracture services across seven former Primary Care Trusts (PCTs) within an English regional health care economy. These hospitals and PCTs represent four distinct models of inpatient hip fracture care with access to a range of overlapping community rehabilitation services.

Survey of access to community rehabilitation services

A standardized questionnaire was used to facilitate structured interviews by one orthogeriatrician, collecting retrospective data regarding provision of orthogeriatric and local community rehabilitation services in 2011/2012, including access criteria. This information was combined with census data on PCT catchment populations to estimate numbers of community beds per 10,000 people aged 65 years and over (7).

Hospital Episode Statistics used in analysis

The flow of patients from the acute hospitals to the community rehabilitation hospitals was established using data extracted from the Hospital Episode Statistics (HES) database (8). We identified patients who had a fractured neck of femur using the International Classification of Diseases, 10th Revisions (ICD-10) codes: S72.0 (Fracture of Neck of Femur); S72.1 (Petrochanteric fracture); and S72.2 (Subtrochanteric fracture). An anonymised patient identifier, derived from the patient's NHS number, was used to identify admissions of the same patient to different hospitals.

Our sample included 1,376 patients who met the following inclusion criteria: admitted to one of four acute trusts with a fractured neck of femur between 1st April 2011 and 29th February 2012; registered with a general practitioner (GP) in one of the seven PCT areas; and with a consecutive record for a spell in a community rehabilitation hospital for patients where the discharge destination from the acute hospital was coded as a transfer to another NHS provider (see Figure 1). A patient's PCT was defined by the address of their registered GP since this determined eligibility for community rehabilitation services.

Variable definitions: Community rehabilitation hospital and lengths of stay

We defined a transfer to a community rehabilitation hospital (CRH) bed as either: a formal discharge from the NHS acute trust and admission to another hospital outside the trust; or a transfer within the same trust from the acute hospital to another site providing either geriatric care, intermediate care or rehabilitation. In order to identify these transfers, we linked admissions of the same patient to different hospitals using three criteria: first, the admission date to the second hospital occurred less than five days after discharge from the acute hospital; second, the discharge destination code for the acute hospital or else the source/method of admission code for the second hospital indicated a transfer; and third, the admission to the second hospital was not coded as an emergency admission.

We calculated length of stay (LOS) in the acute hospital as the number of days between the admission date to the acute hospital and either: the date of discharge from the acute trust; or the date of transfer to a CRH within the same trust.

We calculated the total LOS in the NHS (super-spell) as the number of days between the date of admission to the acute hospital and the final date of discharge from either the acute trust or the CRH if applicable.

We derived other variables to describe characteristics of patients, including: age (as a categorical variable: under 60 years; 60-69 years; 70-79 years; 80-89 years; 90 and over); gender; comorbidity; socio-economic deprivation; and living in a rural area. We used the Royal College of Surgeons of England's modified Charlson Score to calculate a comorbidity score (9). This is based on a number of selected chronic conditions identified using ICD-10 diagnosis codes in HES for the index admission and admissions during the previous year. We used the Index of Multiple Deprivation (IMD) to measure socio-economic deprivation (10). We used the IMD score for a patient's area of residence and then grouped patients into five categories based on the national ranking of local areas. We used the classification of output areas as rural or urban, with a rural area defined as a village, hamlet or isolated dwelling.

Statistical analysis

We used multivariable logistic regression to model the relationship between patient transfer to a CRH and hospital, adjusting for patient characteristics. Adjusted odds ratios are used to summarise differences in CRH use between hospitals.

We used multiple linear regression to model the relationship between the logarithm of patient length of stay (LOS) and hospital, adjusting for patient characteristics. Adjusted differences in LOS are presented as differences in geometric means.

We calculated the adjusted CRH transfer rate and adjusted LOS for each of nine groups defined by combinations of acute hospital and PCT, which together determine access to community rehabilitation services. We used Pearson's correlation coefficient to describe the linear relationship at the group level. We then defined a three-category variable describing CRH use based on the proportion of patients transferred to a CRH (see Table 3). We then used multiple linear regression to model the relationship between log LOS and CRH use, adjusting for patient characteristics. Analyses were carried out using Stata version 11.2.

Results

Acute hospital characteristics

One inner-city teaching hospital (hospital A) and three district general hospitals (hospital B, C, D) served a combined total catchment population of approximately 1.7 million people (Table 1). They each admitted between 300 and 400 patients with hip fracture each year. The three district general hospitals provided a model of joint care between orthogeriatric and trauma and orthopaedic services, whilst the teaching hospital provided a liaison model of orthogeriatric care. Timetabled orthogeriatrician input varied, with the fewest sessions (four hours of either morning or afternoon work) being provided within the teaching hospital, and between 7 and 13 sessions provided within the district general hospitals.

Access to community rehabilitation services

The seven PCTs served a population of around half a million older adults (aged ≥ 65 years). The PCTs had between one and three CRH although in one PCT (PCT 4) only patients registered with specific GPs in one town had access to the CRH beds, otherwise there was no provision. The total number of CRH beds per PCT ranged from 18 to 82, such that the number of CRH beds available per 10,000 older adults ranged from 4 to 20 beds (Data Supplement, Table A).

The number of CRH beds was not the only factor determining access to CRH beds for hip fracture patients. Although each hospital was located in PCTs served by between two and nine CRHs, the two CRHs affiliated with hospital B had very limited bed availability, with the result that most patients were fit to return home before a CRH bed became available.

All PCTs except for one (PCT 7) offered home-base rehabilitation services. One PCT (PCT 2) also had an early supported discharge program, but this operated strict access criteria including: no cognitive deficit; safe to mobilise with aids; and no over-night care needs.

No hospital orthogeriatican retained managerial responsibilities for ongoing rehabilitation of their patients following transfer from the acute hospital.

Characteristics of patients sustaining a hip fracture

Out of 1,376 patients included in the sample, just under a third were male, approximately two thirds were aged 80 years or older, and more than half had at least one comorbid conditions included in the Charlson score (Table 1). Rural living and socio-economic deprivation varied substantially between hospital populations. In two of the acute hospitals, two-fifths of patients lived in areas that fell into the bottom two-fifths of the national ranking of areas by deprivation, and only 4% lived in rural areas. In contrast, the other two acute hospitals served more affluent populations, with less than a fifth of hip fracture patients living in equivalently deprived areas and more than 15% living in rural areas

Influence of patient characteristics on transfer to CRH and length of stay

Older age was the main predictor of being transferred to a CRH and of a longer hospital and super-spell LOS, before and after adjustment for other patient characteristics and for hospital. Having more than one comorbid condition was associated with a lower rate of transfer to a CRH, but was not associated with acute or super-spell LOS after adjustment for patient characteristics. Living in an affluent area was also associated with a lower rate of transfer to a CRH, and a shorter NHS super-spell. After adjustment for other factors, gender and rural living were not associated with the transfer rate to a CRH or with acute or super-spell LOS.

Overall, in-hospital mortality was 9.4%, including a small number of deaths in CRHs. Very few patients transferred to a CRH subsequently died (n=17) and, on average, patients who died in the acute hospital had a shorter acute LOS.

Variation between hospitals in transfer rates to CRH beds and patients' length of stay

Hospital B made very little use of CRH beds, with just 3.4% of their patients transferred to a CRH outside the acute hospital (Table 2). In contrast, hospital A transferred 43.9% to another hospital site for rehabilitation within the same hospital trust. Hospitals C and D discharged approximately two-fifths of their patients to PCT-run CRHs (Table 2).

Patients treated at hospital B, which transferred the fewest patients to CRH beds, had the longest acute LOS, with the average stay being 17.3 days. After adjustment for patients' characteristics, the average stay in hospital B was 5 days longer (95% confidence interval (CI) 2.9 to 7.2 days) than in Hospital A. In contrast, the total NHS super-spell LOS, including time in a CRH, was shortest for patients treated in hospital B, and longest for

hospital A. Of note, hospital A was the only one practicing a liaison rather than joint model of orthogeriatric care.

Influence of transfers to CRH beds on hospital length of stay

We divided the study population into nine groups according to acute hospital and PCT (Table 3). Higher rates of CRH transfer corresponded with shorter stays in the acute hospital, but longer overall NHS super-spells (Figure 2). There was a negative linear correlation between higher transfer rates and acute LOS (r = -0.9, P = 0.003) and weak evidence of a positive linear correlation with super-spell LOS (r = +0.5, P = 0.16).

The nine groups were collapsed into three categories based upon rate of transfer to a CRH (Table 3). Table 4 presents the associations between transfer rates, as a categorical variable, and length of stay. High transfer rates (>40%) were associated with a shorter acute hospital LOS (adjusted difference 5.7 days, 95% CI 4.2 to 7.1 days), but longer NHS super-spell LOS (adjusted difference 3.4 days, 95% CI 0.6 to 6.7 days). In contrast, medium transfer rates (20-40%) corresponded to a shorter acute hospital LOS (adjusted difference 4.3 days, 95% CI 2.8 to 5.6 days, p<0.001) but no difference in NHS super-spell LOS (0.8 days, 95% CI -1.3 to 3.1 days, p=0.5).

Hospital D discharging to PCT 7 had the highest transfer rate, with 54.7% of hip fracture patients being transferred to a CRH (Table 3). PCT 7 was also the only PCT lacking a home-based rehabilitation service. Of all PCTs, it had the longest NHS super-spell, with the average stay being 9.2 days longer (95% CI 3.8 to 16.1 days) than the PCT with the shortest super-spell LOS (Data Supplement, Table B).

Discussion

Main findings of this study

In a geographical area of England that covered half a million people over 65 years, we identified considerable variation in access to and use of community rehabilitation services for hip fracture patients. The number of community rehabilitation hospital beds available per 10,000 older adults (aged ≥ 65 years) ranged from 4 to 20 beds between the seven PCTs in the region. Access criteria also varied; for example, in one PCT, only patients registered with specific GPs in one town had access to the CRH beds. Rates of transfer to a CRH ranged from 2.1% to 54.7% between patient groups defined by acute hospital and PCT.

Variation in the use of CRH beds was in turn associated with differences in hospital length of stay. High rates of transfer (>40% versus <5% of patients transferred to a CRH) were

associated with shorter acute hospital stays but longer NHS super-spells (adjusted difference 3.4 days, 95% CI 0.6 to 6.7 days). In turn, medium transfer rates (20-40% of patients transferred) were associated with shorter acute hospital stays (adjusted difference 4.3 days, 95% CI 2.8 to 5.6 days), but without a reciprocal rise in NHS super-spell.

Findings in context

From a patient's perspective, the advantages of transfer to a community rehabilitation hospital may include being closer to home, family and friends, as well as local community rehabilitation teams; factors potentially of greater importance in geographically remote rural areas. The two hospitals (C and D) with larger rural populations transferred more patients to CRHs, potentially for this reason. Balanced against this are potential negative aspects of transfer, including: regression in rehabilitation progress due to the disruption of a transfer; the need to become familiar with another health care team; the risk of less intensive rehabilitation in slower-stream units without dynamic leadership; and lack of access to acute hospital services in case of clinical deterioration.

In England and Wales, NICE has issued specific guidance regarding commissioning of high-quality hip fracture care for up to 6 weeks following hospital discharge, stating patients should be offered early supported discharge when appropriate (6); a service we found to be available in only one PCT. NICE also state that continued rehabilitation in a CRH should only be considered if the hip fracture clinical team retain managerial responsibility, ensuring that CRHs are not used as a substitute for effective acute hospital rehabilitation. However, in our study, no hospital orthogeriatican retained managerial responsibilities for ongoing rehabilitation following transfer from the acute hospital.

What is already known on this topic?

There is some evidence from the UK on the relative efficiency and effectiveness of different institutional arrangements for providing post-fracture rehabilitation care (11). A study of eight hospitals in East Anglia found patients treated in hospitals with a policy of transferring to other wards prior to discharge had a longer average length of stay (12). A comparison between Peterborough and Edinburgh hospitals found that routine transfer of patients to a Geriatric Orthopaedic Rehabilitation Unit was associated with a shorter average stay on the orthopaedic ward but a longer overall hospital stay (13). The introduction of the Peterborough hip fracture service in 1986, including the "Hospital at Home" scheme, increased the proportion of patients discharged directly home over an 11-year period from

50% to 86%, reduced transfer rates to other wards (from 43% to 9%) and decreased length of stay from 51 to 21 days (14).

In the US, the number of rehabilitation facilities and distance from a patient's home have been found to be stronger determinants of where patients received post-acute rehabilitation than individual characteristics (15, 16). A systematic review of 30 randomized and 25 non-randomized studies of hip fracture rehabilitation concluded that clinical pathways providing intensive therapy and early supported discharge were associated with improved functional recovery, whilst less intense post-acute 'skilled nursing facility' rehabilitation was associated with a longer length of stay (17).

Study strengths and limitations

This study is the first to combine data from acute and community rehabilitation hospitals to examine the effect of different institutional arrangements for providing rehabilitation care within the NHS. Its strengths come from using interviews to establish a detailed picture of service provision and from using data from a national dataset to describe the flow of patients between acute and rehabilitation hospitals. The comprehensiveness of HES allowed us to match admissions of the same patient to acute and community rehabilitation beds funded by the NHS.

Our study relates to activity in one regional health care economy in South West England and may not be generalisable across the country. On the other hand, the study population had similar demographic characteristics to the national hip fracture population and contained similar between-hospital variation in acute and super-spell length of stay (18).

Another limitation is that the HES database does not capture admissions to private hospitals. However, in England, almost all hip fractures are expected to pass through NHS care. Our orthogeriatrician survey did not identify even occasional use of private residential rehabilitation services. Each of the acute hospitals did have access to a small number of social care funded rehabilitation beds that are not captured within HES, and this could lead to a slight underestimate of use of CRH beds, but is unlikely to bias estimates of the influence of CRH transfers on LOS.

Around 10% of patients who were coded as being transferred from the acute hospital to another NHS hospital had a missing consecutive record. However, these missing records were concentrated in one particular PCT, constituting nearly a third of discharges from one acute hospital to that PCT. We conducted two analyses to check the sensitivity of our

findings to this potential source of bias. First, we re-ran the analyses excluding this PCT. Second, we re-ran the analyses using HES data for the previous financial year (2010-11), since the data for the previous year was more complete. This sensitivity analysis suggests that, whilst the main analyses presented underestimate rates of transfer to a CRH and super-spell LOS for one acute hospital, the conclusions about the relationship between CRH use and acute and super-spell LOS remain unaltered.

We were unable to wholly distinguish the influence of acute orthogeriatric services from the influence of transfer to a community rehabilitation hospital, since only one hospital had very low rates of transfer to a CRH, whereas the other three hospitals had either medium or high rates of CRH transfer. Finally, the HES database does not contain information on some potential confounders such as pre-fracture mobility. Further, we used the validated Charlson comorbidity index to adjust for individual patient comorbidity (19), according to which 40% of our study population were deemed free of comorbidity, which also raises the possibility of residual confounding.

Unanswered questions for future research

Our study focused on one English region. The results provide insight into the relationship between access and length of stay but its results are limited to describing the impact of one set of institutional arrangements. It is important that studies are undertaken in other locations to extend our understanding of how different institutional arrangements for providing rehabilitation care on the clinical affect the cost effectiveness of care. Outcomes and patient experience are another important research area, and may vary between patient groups; *e.g.*, the impact on the rate of return home, 30-day readmissions, in-hospital falls and repeat hip fracture (contra-lateral and/or peri-prosthetic). The extent to which financially-pressured hospital management systems drive CRH transfers, over the influence of the clinical team is also not known.

Conclusions and policy implications

Access to post-fracture rehabilitation care varied within a regional health care economy in South West England. Inequity in access to community rehabilitation services is inconsistent with the government's strongly promoted policy of patient choice, aimed at reducing inequalities in access to healthcare, improving responsiveness and quality of services (20), and reducing the 'postcode lottery' model in service provision for older people (21).

Poor access to home-based rehabilitation services is arguably inefficient, as well as inequitable. Lack of a community home-based rehabilitation service was associated with over-reliance on bed-based services. In turn, over-reliance on CRH beds (> 40% transfer rate) was associated with a reduction in acute hospital bed-days, but at the expense of an increased NHS super-spell.

These findings have relevance to current clinical commissioning groups planning intermediate care services. In 2011/2, the average cost of an excess acute hospital bed day was £264 (22), with a CRH bed £252/day (2). As an illustration, we estimate that the savings to the English NHS of reducing transfer rates from 50% (high use) to 20% (medium use) for 20,000 hip fracture patients could be £19 million a year. This estimate is based on data from our study on the effect of transfers to CRH beds on LOS, plus published data from the NHFD 2013 report on location of rehabilitation care, which showed that a quarter of hospital trusts discharge >50% of their patients to a rehabilitation unit, whilst 15% provide rehabilitation on a separate ward within the trust (3). Balanced against this potential saving would be the costs of home-based rehabilitation care, often required for early hospital discharge, although home-based services have lower costs per service user (2).

Appropriate and equitable commissioning of post-fracture rehabilitation services is required, in collaboration with clinical hip fracture teams, to ensure fair access governed by clinical need and patient choice rather than geography, as well as by efficiency in care.

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Transparency declaration: The lead author (JN) affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned have been explained.

Ethical approval: The study is exempt from UK National Research Ethics Committee approval as it involved analysis of an existing dataset of anonymised data for service evaluation. Approvals for the use of hospital episode statistics data were obtained as part of the standard hospitals episode statistics approval process.

Data sharing: No additional data available.

Figure 1 Hip fracture sample selection illustrated as a flow diagram

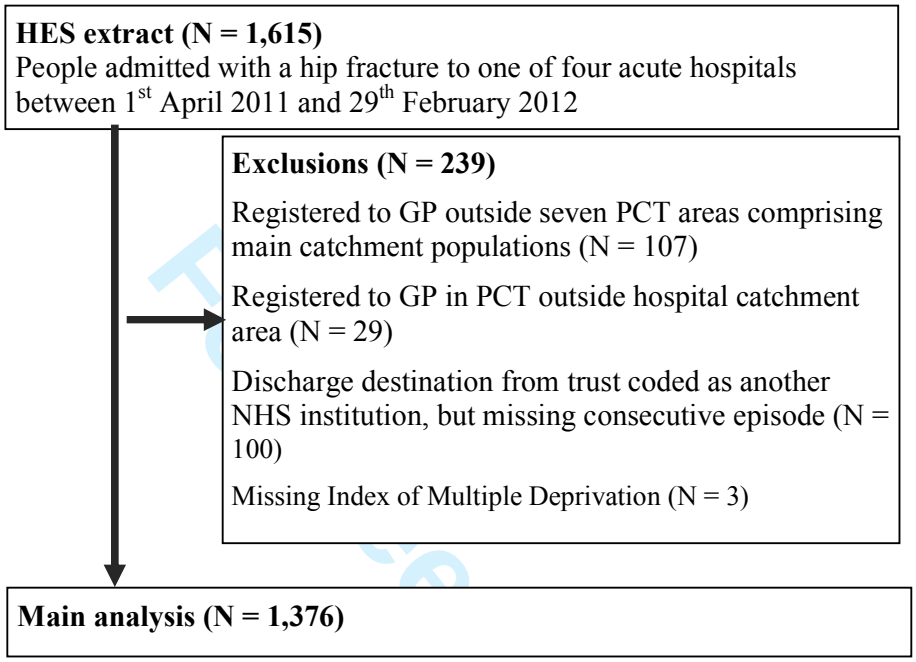
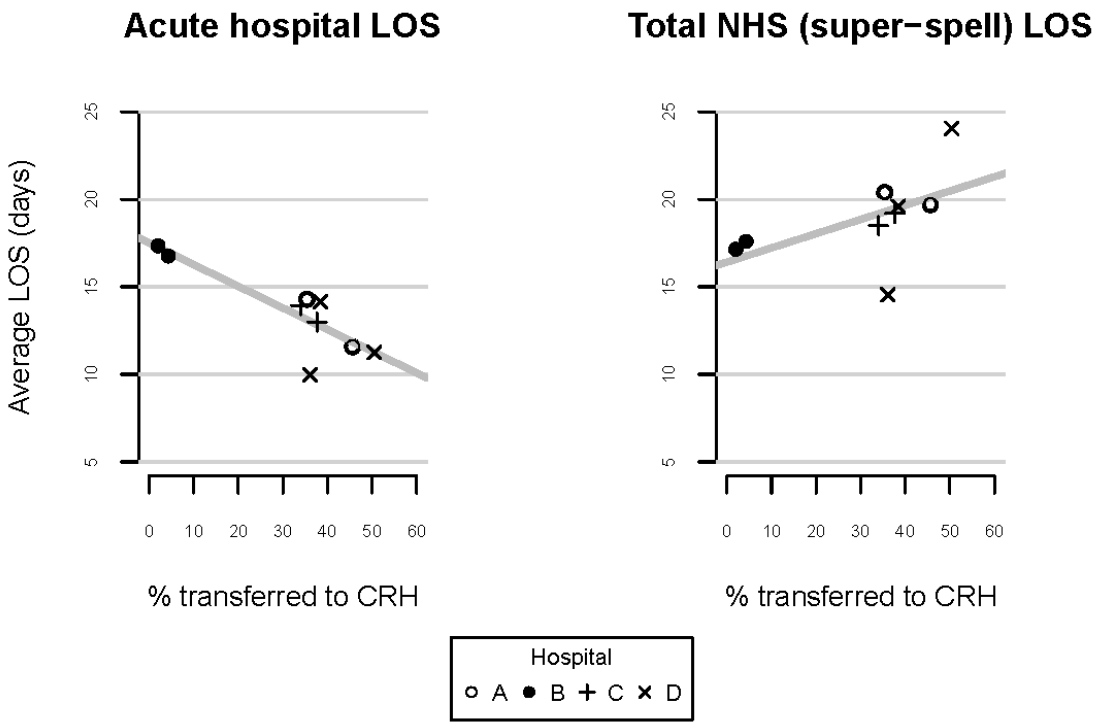


Figure 2 Relationship between adjusted rate of transfer to community rehabilitation hospital and: a) adjusted acute length of stay; and b) adjusted NHS 'super-spell' length of stay



Adjusted for patients' age, sex and comorbidity, socio-economic deprivation and rural habitation.

CRH: Community Rehabilitation Hospital. LOS: Length of Stay

Table 1 Description of hospital characteristics and patients treated after sustaining a fracture neck of femur, 1st April 2011 to 29th February 2012

	Hospital A	Hospital B	Hospital C	Hospital D
Hospital characteristics				
Approximate catchment population	300,000	500,000	400,000	500,000
Teaching/DGH	Teaching	DGH	DGH	DGH
Orthogeriatrician input	Liaison	Joint care	Joint care	Joint care
Orthogeriatrican sessions/week	3	7	13	10[a]
No. of PCTs at discharge[b]	3	3	2	4
No. of CRHs at discharge[b,c]	3	2	7	9
#NOF patient characteristics				
No. #NOF	303	326	348	399
Female, n (%)	220 (73%)	249 (77%)	246 (71%)	302 (76%)
Age ≥ 80 years, n (%)	208 (69%)	231 (71%)	235 (68%)	280 (70%)
Living in deprived area, n (%)[d]	135 (45%)	119 (37%)	66 (19%)	60 (15%)
Living in rural area, n (%)	11 (4%)	15 (5%)	54 (16%)	92 (23%)
RCS Charlson Score ≥1, n (%)[e]	168 (55%)	170 (52%)	200 (57%)	236 (59%)

DGH: District General Hospital, PA: Programmed activity, PCT: Primary Care Trusts, CRH: Community Rehabilitation Hospital, Joint care: Formal joint care between orthogeriatric and trauma and orthopaedic services.

[a]Includes 5 sessions provided by a specialist trainee. [b]Hospitals may discharge small numbers of patients to other PCTs that were not included in this analysis. [c]Each hospital also had access to a small number of beds in one additional social care funded community rehabilitation facility. [d]Areas in the bottom two-fifths of the national ranking of areas by the Index of Multiple Deprivation (IMD). [e]The Royal College of Surgeons (RCS) Charlson Score (see methods).

Table 2 Transfer rate to a community rehabilitation hospital and length of stay in acute hospital and NHS (super-spell) by acute hospital

Outcomes by hospital	Average [b]	Adjusted OR or difference (95% CI) [c]	p value
Transferred to a CRH (%)			
A (reference) [a]	43.9 %	1.0	-
B	3.4 %	0.0 (0.0 to 0.1)	<0.001
C	35.6 %	0.8 (0.6 to 1.1)	0.1
D	39.8 %	0.9 (0.7 to 1.3)	0.6
Acute hospital LOS (days)			
A (reference)	12.5	0.0	-
B	17.3	5.0 (2.9 to 7.2)	<0.001
C	13.2	1.0 (-0.5 to 2.8)	0.2
D	11.8	-0.4 (-2.1 to 1.1)	0.6
NHS super-spell (days)			
A (reference)	20.5	0.0	-
B	17.8	-2.6 (-4.9 to 0.1)	0.06
C	18.5	-1.1 (-3.6 to 1.9)	0.5
D	17.8	-1.9 (-4.3 to 0.9)	0.2

CRH: Community Rehabilitation Hospital. LOS: Length of Stay. OR: Odds Ratio. CI: Confidence Interval.

[a] These represent transfers from the acute hospital to a CRH run by the same trust. [b] For LOS, the average number of days indicates the geometric mean (see methods). For the binary outcome (CRH transfer) the average is the overall percentage. [c] Adjusted for patients' age, sex and comorbidity, plus the socio-economic deprivation and rurality of residential area.

Table 3 Categories of community rehabilitation hospital use, by acute hospital and Primary Care Trust

	Hospital A	Hospital B	Hospital C	Hospital D
% transferred to CRH (n [a])				
PCT 1	-	-	-	35.0% (146)
PCT 2	-	4.3% (185)	-	-
PCT 3	47.2% (233)	2.1% (141)	-	-
PCT 4	32.9% (70)	-	-	-
PCT 5	-	-	38.0% (211)	-
PCT 6	-	-	32.1% (137)	38.6% (189)
PCT 7	-	-	-	54.7% (64)
Category of CRH use				
PCT 1	-	-	-	Medium
PCT 2	-	V. low	-	-
PCT 3	High	V. low	-	-
PCT 4	Medium	-	-	-
PCT 5	-	-	Medium	-
PCT 6	-	-	Medium	Medium
PCT 7	-	-	-	High

CRH: Community Rehabilitation Hospital. PCT: Primary Care Trust

[a] Number in brackets is the total number of patients treated in hospital and PCT.

Table 4 Acute hospital and NHS super-spell length of stay, by category of community rehabilitation hospital bed use

	Average[a]	Adjusted[b] difference or OR (95% CI)	p value
Transferred to a CRH (%)[a]		Adjusted OR	
Very low (n = 322, reference)	3.4%	1	-
Medium (n = 740)	36.0%	19 (10 to 35)	<0.001
High (n = 296)	48.8%	29 (15 to 55)	<0.001
Acute hospital LOS (days)		Adjusted difference	
Very low (reference)	17.3	0.0	-
Medium	12.7	-4.3 (-5.6 to -2.8)	<0.001
High	11.8	-5.7 (-7.1 to -4.2)	<0.001
NHS super-spell (days)		Adjusted difference	
Very low (reference)	17.8	0.0	-
Medium	17.8	0.8 (-1.3 to 3.1)	0.5
High	21.5	3.4 (0.6 to 6.7)	0.02

[a] The transfer rate was used to categorise use of Community Rehabilitation Hospitals (CRHs) by hospital and PCT. Very low: < 5% patients from PCT transferred to a CRH. Medium: between 20% and 40%. High: > 40% patients from PCT transferred to a CRH. [b] Adjusted for patients' age, sex and comorbidity, plus socio-economic deprivation and rural habitation.

Data supplement

Table A Number of Community Rehabilitation Hospital beds available per 10,000 adults aged 65+ years

	Total no. adults aged ≥65[a]	Acute hospitals serving PCT	No. of CRHs	No. CRH beds	No. CRH beds per 10,000 adults aged ≥65
PCT 1	32,059	A, D	2	59	19
PCT 2	44,756	B	1	20	5
PCT 3	56,074	A, (B)[b]	2[b]	78	14
PCT 4	43,047	A	1[c]	18	4
PCT 5	29,844	C	1	60	20
PCT 6	86,434	C, D	3[d]	82	9
PCT 7	11,2724	D	3	75	7

CRH: Community Rehabilitation Hospital, PCT: Primary Care Trust

[a] Taken from ONS Mid-2011 Population Estimates for Primary Care Organisations in England by Single Year of Age and Sex; based on the results of the 2011 Census

[b] In practice these 78 community beds, together with limited availability of social care facility beds, are predominantly available to hospital A, not hospital B.

[c] Not available to all individuals within this PCT, rather only available to patients registered with specific GPs in one town, otherwise no CRH available.

[d] Plus one social care facility with 6 available beds

Table B Variation in acute hospital and super-spell length of stay by Primary Care Trust

Outcomes by PCT	Average	Adj. diff. (95% CI)[a]	p value
Acute Hospital LOS (days)			
PCT 1 (n = 146)	9.7	0.0	
PCT 2 (n = 185)	16.9	6.8 (4.2 to 9.9)	<0.001
PCT 3 (n = 374)	14.0	3.6 (1.6 to 5.9)	<0.001
PCT 4 (n = 70)	14.0	4.3 (1.5 to 7.9)	0.001
PCT 5 (n = 211)	13.1	3.0 (1.0 to 5.4)	0.002
PCT 6 (n = 326)	13.8	4.0 (2.0 to 6.3)	<0.001
PCT 7 (n = 64)	10.9	1.0 (-1.2 to 3.9)	0.4
NHS Super-spell (days)			
PCT 1	13.9	0.0	
PCT 2	17.6	2.9 (0.0 to 6.5)	<0.05
PCT 3	19.8	4.3 (1.2 to 7.9)	<0.004
PCT 4	19.2	5.5 (1.2 to 11.0)	0.01
PCT 5	19.3	4.5 (1.3 to 8.3)	0.004
PCT 6	18.5	4.5 (1.6 to 7.9)	0.002
PCT 7	24.0	9.2 (3.8 to 16.1)	<0.001

PCT: Primary Care Trust. LOS: Length of Stay. CI: Confidence Interval. [a] Adjusted for patients' age, sex and comorbidity, plus the socio-economic deprivation and rural habitation.

	Item No	Recommendation
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract Cross-sectional study (Title - Page 1)
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found Abstract - Page 2
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported Pages 3-4
Objectives	3	State specific objectives, including any prespecified hypotheses Page 4
Methods		
Study design	4	Present key elements of study design early in the paper Pages 5-6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection Pages 5- 6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants Page 5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable Page 6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group Pages 6-7

Bias	9	Describe any efforts to address potential sources of bias Page 6 and Pages 11-12
Study size	10	Explain how the study size was arrived at Page 5 and Figure 1
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why Page 6
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding Pages 6-7
		(*b*) Describe any methods used to examine subgroups and interactions None undertaken
		(*c*) Explain how missing data were addressed Pages 11-12
		(*d*) If applicable, describe analytical methods taking account of sampling strategy N/A
		(*e*) Describe any sensitivity analyses Pages 11-12
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed Figure 1
		(b) Give reasons for non-participation at each stage N/A
		(c) Consider use of a flow diagram Figure 1

Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders Page 8
		(b) Indicate number of participants with missing data for each variable of interest Figure 1 and Table 1
Outcome data	15*	Report numbers of outcome events or summary measures Tables 2 and 4
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included Tables 2 and 4
		(*b*) Report category boundaries when continuous variables were categorised Table 3
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses N/A
Discussion		
Key results	18	Summarise key results with reference to study objectives Page 10
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias Pages 11-12
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence Pages 10-14
Generalisability	21	Discuss the generalisability (external validity) of the study results Pages 11 and 13
Other information		

Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based Page 15

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Variation in access to community rehabilitation services and length of stay in hospital following a hip fracture: a cross-sectional study

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Variation in access to community rehabilitation services and length of stay in hospital following a hip fracture: a cross-sectional study

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ABSTRACT

Objectives: To assess variation in access to and use of community rehabilitation services for patients with a hip fracture, and whether this affects length of stay in hospital.

Design: Cross-sectional study using administrative patient-level data from Hospital Episode Statistics (HES) and organisational survey data.

Setting: A regional health economy in South West England served by four acute NHS hospital trusts and six former Primary Care Trusts (PCTs).

Population: 1,230 hip fracture patients treated in an acute hospital between 1st April 2011 and 29th February 2012.

Main outcomes: Information about access to community rehabilitation services for each acute hospital and PCT, reported by organisational survey. Rates of patients transferred from acute hospital to community rehabilitation hospitals (CRH) across eight groups with varying access; determined by acute hospital and PCT. Median lengths of stay in the acute hospital, and in the acute hospital plus CRH combined. Associations between the rate of transfer to a CRH and median lengths of stay assessed using Spearman's rank correlation coefficient (rs).

Results: Access to community rehabilitation services varied, including the number of CRH inpatient beds, formal access criteria and waiting times. In one PCT, no home-based rehabilitation service was available. The percentage of patients transferred to a CRH ranged from 2.1% to 54.7%. A higher transfer rate was associated with a shorter median length of stay in the acute hospital (rs = -0.8; P = 0.01), but a longer median combined length of stay in the acute hospital and CRH (rs = +0.7; P = 0.04).

Conclusion: Within one geographical area, there was wide variation in availability and use of community rehabilitation services for patients discharged from an acute hospital following a hip fracture. Reliance on transfers to community rehabilitation hospitals was associated with a longer length of stay in the NHS.

Study strengths and limitations

- This study is the first to combine data from acute hospitals and community rehabilitation hospitals (CRHs) to examine different institutional arrangements for providing rehabilitation care.
- The comprehensiveness of the Hospital Episode Statistics (HES) allowed us to match admissions of the same patient to acute and community rehabilitation beds.
- Our study relates to activity in one geographical area in South West England and may not be generalisable across the country.
- The HES database does not capture admissions to private hospitals. However, in England, almost all hip fractures are expected to pass through NHS care. Our organisational survey did not identify even occasional use of private residential rehabilitation services.
- Each of the acute hospitals had access to a small number of social care funded rehabilitation beds that are not captured within HES. This could lead to a slight underestimate of use of CRH beds and total institutional length of stay.

What is already known on this topic

- Hip fractures are common among older people and account for significant expenditure in the NHS
- Acute hospital length of stay after hip fracture varies widely, but can be shortened by services providing ongoing rehabilitation either at home or within a community rehabilitation hospital.

What this paper adds

- Within a defined region in South West England, we found marked variation in access to community rehabilitation services following a hip fracture, varying by both acute hospital and PCT.
- Correspondingly, we identified was large variation in rates of transfer from acute hospitals to community rehabilitation hospitals.
- A higher rate of transfer was associated with a shorter length of stay in the acute hospital, but a longer combined length of stay, suggesting reduced efficiency.

Introduction

An important element of ensuring a safe hospital discharge is the provision of appropriate services to support individuals in the community, including ongoing rehabilitation when indicated (1). When provided early, such services can reduce length of stay in the acute hospital; although some frailer patients may benefit from extended inpatient rehabilitation to achieve a discharge home. However, the 2013 National Audit of Intermediate Care highlighted wide variation in the number, location and staffing of rehabilitation services across the country, (2) with no improvement in capacity since the previous year (3). Little is known of the variation in access to community rehabilitation services for specific patient groups, and the impact on length of hospital stay.

Around 60,000 older adults fracture a hip each year in England (4), and the number is projected to increase with our ageing population. Such fractures represent a major trauma for individuals and a significant societal burden, both through direct health service costs (UK estimated £1.8 billion in 2000), and important social sequelae (5). Since its launch in 2007, the National Hip Fracture Database (NHFD) supported by the 'Blue Book', has highlighted the importance of geriatrician-led multidisciplinary rehabilitation (1). In 2012, the National Institute for Clinical Excellence (NICE) issued specific guidance (CMG46) on commissioning high-quality post-acute hip fracture care for up to six weeks following hospital discharge (6).

The 2013 NHFD report revealed wide variation in institutional arrangements for providing rehabilitation care following hip fracture, and wide variation in length of stay following a hip fracture: the average length of stay in NHS hospitals was 22 days, but this figure ranged from 12.9 to 33.5 days, nearly a three-fold variation (4). With its focus on care provided within the acute hospital, the NHFD report was not able to identify external drivers of variation in length of stay, given the complex and heterogeneous provision of rehabilitation care. Ours is the first study to evaluate the impact of variation in community rehabilitation services, provided outside the acute hospital, on length of stays in the acute hospital and in the NHS overall.

We aimed to assess variation in access to and use of community rehabilitation services provided outside the acute hospital within one geographical area in England. First, we conducted an organisational survey to identify variation in access to community rehabilitation services across four NHS acute hospitals and their affiliated former Primary Care Trusts.

Second, we analysed administrative patient-level data from the Hospital Episode Statistics to calculate rates of transfer from acute hospitals to community rehabilitation hospitals across eight patient groups categorised by combinations of their acute hospital and their PCT. Third, we analysed the relationship between rate of transfer and average lengths of stay, in order to evaluate the efficiency of different institutional arrangements for providing rehabilitation care within the NHS.

Methods

Study setting

Our study focused on one defined geographical area in South West England served by four NHS acute hospital trusts. One inner-city teaching hospital (hospital A) and three district general hospitals (hospitals B, C, D) served a combined total catchment population of approximately 1.7 million people. The acute hospitals represent four distinct models of inpatient hip fracture care with access to a range of community rehabilitation services provided by the acute trust or by former Primary Care Trusts (PCT). We defined a community rehabilitation hospital (CRH) as a local NHS institution providing on-site integrated health and social care with specifically *inpatient* access to physiotherapy for the purpose of rehabilitation; this contrasts with home-based rehabilitation and care services provided after discharge from a hospital in a patient's own home.

Organisational survey of orthogeriatricians regarding access to community rehabilitation services

A standardized questionnaire was used to facilitate structured interviews with hospital orthogeriatricians, all conducted by one orthogeriatrician (CLG), collecting retrospective data regarding provision of orthogeriatric and local community rehabilitation services in 2011/2012. Information was collected regarding: the orthogeriatric service model, source PCTs for admissions; CRHs and other residential intermediate care facilities to which patients could be transferred or discharged within each acute trust and PCT; availability of home-based community rehabilitation services within each PCT and access criteria; and ongoing clinical or managerial responsibility for patients following transfer to a CRH. Respondents were also given the opportunity to comment on other system issues relating to access (see supplementary appendix). This survey information was combined with 2011 Census data on PCT catchment populations to crudely estimate numbers of community rehabilitation beds per 10,000 people aged 65 years and over (7).

Hospital Episode Statistics used in statistical analysis

The flow of patients from acute hospitals to CRHs was established using an extract of patient-level data extracted from an anonymised copy of the Hospital Episode Statistics (HES) database. The HES database contains administrative records describing the care of all hip fracture patients admitted to hospitals providing NHS-funded care in England, including acute and community hospitals (8). Patients' diagnoses are coded using ICD-10 (International Classification of Diseases, 10th revision), and procedures are coded using the classification of surgical operations from the UK Office of Population Censuses and Surveys (OPCS), version 4 (Figure 1).

We identified patients who had a fractured neck of femur using the ICD-10 disease codes: S72.0 (Fracture of Neck of Femur); S72.1 (Petrochanteric fracture); and S72.2 (Subtrochanteric fracture). An anonymised patient identifier, derived from the patient's NHS number, was used to match admissions of the same patient to different hospitals.

Our sample included 1,230 patients who met the following inclusion criteria: admitted to one of four acute trusts with a fractured neck of femur between 1st April 2011 and 29th February 2012 (11 months used to avoid downward bias of estimates of LOS due to truncation of spells at 30th March 2012); and registered with a general practitioner (GP) in one of the seven PCT areas. A patient's PCT was defined by the address of their registered GP, because this determined formal eligibility for services. For patients who had their discharge destination coded as a transfer from the acute hospital to another NHS provider, we excluded those missing a record for a subsequent admission to a CRH or other NHS hospital. We excluded all patients from one PCT affiliated with Hospital D because a third of CRH records were missing.

Variable definitions: Community rehabilitation hospital and lengths of stay

We defined a transfer to a CRH bed as either: a formal discharge from the NHS acute trust and admission to a community hospital outside the trust; or a transfer within the same acute trust from the acute hospital to another site providing geriatric care, intermediate care or rehabilitation. In order to identify these transfers, we matched admissions of the same patient to different hospitals using the following criteria: the discharge destination code for the acute hospital or else the source/method of admission code for the second hospital indicated a transfer; and the admission to the second hospital was not coded as an emergency admission.

We calculated length of stay (LOS) in the acute hospital as the number of days between the admission date to the acute hospital and the date of discharge from, or transfer out of, the acute hospital. We calculated the combined LOS in the acute hospital and CRH as the number of days between the date of admission to the acute hospital and the final date of discharge, from the CRH if the patient was transferred, or from the acute hospital if the patient was not transferred.

We derived other variables to describe patient characteristics, including: age (as a categorical variable: under 60 years; 60-69 years; 70-79 years; 80-89 years; 90 and over); gender; comorbidity; socio-economic deprivation; and living in a rural area. We used the Royal College of Surgeons of England's modified Charlson Score to calculate a comorbidity score (9). This is based on a number of selected chronic conditions identified using ICD-10 diagnosis codes in HES for the index admission and admissions during the previous year. We used the Index of Multiple Deprivation (IMD) to measure socio-economic deprivation (10). We used the IMD score for a patient's area of residence and then grouped patients into five categories based on the national ranking of local areas. We used the classification of output areas as rural or urban, with a rural area defined as a village, hamlet or isolated dwelling.

Statistical analysis

We calculated the rate of transfer from the acute hospital to CRHs for each of eight patient groups categorised by combinations of their acute hospital and PCT. We categorised the data in this way because it is the combination of acute hospital and PCT that determines patient access to community rehabilitation services. For example, access will depend upon formal and informal institutional arrangements such as: whether the acute hospital is part of a larger organizational unit (acute NHS trust) running its own CRH; agreed eligibility criteria and referral arrangements between providers; proximity of services to a patient's home; and waiting times for CRH beds.

We used the χ^2 test to assess differences in transfer rates between groups. We used Spearman's rank correlation coefficient r_s to measure associations between the transfer rate and: median LOS in the acute hospital; and median LOS in the acute hospital and CRH combined, across the eight groups. We also checked correlations between adjusted measures (see Supplementary Appendix for details). Data were analysed using Stata version 11. Reported P values are two sided.

Results

Acute hospital services

Each hospital admitted between 300 and 400 patients with hip fracture each year. The three district general hospitals provided a model of joint care between orthogeriatric and trauma and orthopaedic services, whilst the teaching hospital provided a liaison model of orthogeriatric care. Timetabled orthogeriatrician input varied, with the fewest clinical sessions being provided within the teaching hospital and between 7 and 13 sessions provided within the district general hospitals (Table 1).

Access to community rehabilitation services

The six PCTs served a population of around half a million older adults (aged ≥ 65 years). Each PCT was served by one or two acute hospitals and had access to between one and three CRHs. The total number of CRH beds per PCT ranged from 18 to 82, and the number of CRH beds available per 10,000 older adults ranged from 4 to 20 (Data Supplement, Table A). Each hospital was located in PCTs served by between two and nine CRHs (Table 1).

Access to CRH beds depended upon the allocation of beds and referral arrangements, not only on the number of CRH beds. One of the acute hospitals (Hospital A) was part of a larger acute trust that ran its own CRH. In one PCT (PCT 1) only patients registered with specific GPs in one town had access to the PCT-run CRH. The two CRHs affiliated with hospital B had very limited availability and long waiting times, with the result that most patients were fit to return home before a CRH bed became available.

All PCTs except for one (PCT 6) offered home-based community rehabilitation services. One PCT (PCT 3) had an early supported discharge program, but this operated strict access criteria including: no cognitive deficit; safe to mobilise with aids; and no over-night care needs.

No acute hospital orthogeriatician retained clinical or managerial responsibilities for ongoing rehabilitation of their patients following transfer to a CRH.

Characteristics of patients sustaining a hip fracture

Out of 1,230 patients included in the sample, just under a third were male, approximately a fifth were aged 90 years or older, and more than half had at least one comorbid condition included in the Charlson score (Table 2). Rural living and socio-economic deprivation varied between acute hospital hip fracture populations. Two of the acute hospitals treated a mix of

patients who lived in deprived and affluent areas, but where only 4% lived in rural areas. In contrast, the other two acute hospitals served more affluent populations, with 15.5% and 23.7% from rural areas respectively.

Variation in rates of transfer to CRH beds

Table 3 displays the transfer rates to CRH beds across eight patient groups according to combinations of their acute hospital and PCT. Rates of transfer ranged from 2.1% to 54.7%, representing substantive and statistically significant variation (P <0.001).

Comparing these figures to the organisational survey findings, the patient groups with the lowest transfer rates were treated in an acute hospital (Hospital B) that reported very poor access to CRH beds for its patients across both its PCTs. The patient group with the highest CRH transfer rate (Hospital D, transferring to PCT 6) occurred in the only PCT without access to a home-based rehabilitation service.

Influence of transfer rate to CRH on length of stay

Median LOS in the acute hospital ranged from 11 to 19 days. Median combined LOS in the acute hospital and CRH ranged from 17 to 27.5 days. A higher rate of CRH transfer was associated with a shorter median LOS in the acute hospital (r_s = -0.8; P = 0.01), but a longer combined LOS (r_s = +0.7; P = 0.04). Whilst there was a clear linear relationship between higher CRH transfer rates and reduced acute hospital LOS, the relationship with combined length of stay was not linear. Only high transfer rates seemed to be associated with a more marked increase in combined LOS (Figure 2).

Adjustment for age, gender, comorbidity, socio-economic deprivation and rural habitation did not change the associations between transfer rates and LOS (Supplementary Appendix).

Discussion

Main findings of this study

In a geographical area of England that covered half a million older adults, we identified considerable variation in access to and use of community rehabilitation services following acute hospitalization for a hip fracture. Across the PCTs, the number of community rehabilitation hospital (CRH) beds available ranged from 4 to 20 beds per 10,000 older adults (aged ≥ 65 years). Access criteria also varied; for example, in one PCT, only patients registered with specific GPs in one town had access to the CRH beds. Rates of transfer from

the acute hospital to a CRH ranged from 2.1% to 54.7% between patient groups with different levels of access to community rehabilitation services.

Variation in transfer rates to CRH beds was in turn associated with differences in median hospital length of stay. A higher rate of CRH transfer was associated with a shorter average length of stay in the acute hospital, but a longer average combined length of stay in the acute hospital and CRH.

Findings in context

From a patient's perspective, the advantages of transfer to a CRH may include being closer to home, family and friends, as well as local community rehabilitation teams; factors potentially of greater importance in geographically remote rural areas (11). This may explain why the two hospitals (C and D) with larger rural populations transferred more patients to CRHs. Balanced against this are possible negative aspects of transfer, such as: delayed rehabilitation progress due to the disruption of a transfer; the need to become familiar with another health care team; and the risk of less intensive rehabilitation in slower-stream units.

In England and Wales, NICE has issued specific guidance regarding commissioning of high-quality hip fracture care for up to 6 weeks following hospital discharge, stating patients should be offered early supported discharge when appropriate (6); a service we found to be available in only one PCT. NICE also state that continued rehabilitation in a CRH should only be considered if the hip fracture clinical team retains managerial responsibility, ensuring that CRHs are not used as a substitute for effective acute hospital rehabilitation. However, in our study, no hospital orthogeriatrician retained clinical or managerial responsibility for ongoing rehabilitation following transfer from the acute hospital. As transfers often involve moves between organizations and hence lines of accountability and employment, this is perhaps not surprising. The increasing development of community geriatricians may offer some scope to improve continuing of care (12).

What is already known on this topic?

There is some evidence from the UK on the relative efficiency and effectiveness of different institutional arrangements for providing post-fracture rehabilitation care. A study of eight hospitals in East Anglia found patients treated in hospitals with a policy of transferring to other wards prior to discharge had a longer average length of stay (13). A comparison of two hospitals found that routine transfer of patients to a Geriatric Orthopaedic Rehabilitation Unit in one hospital was associated with a shorter average stay on the orthopaedic ward but a

longer hospital stay (14). The introduction of the Peterborough hip fracture service in 1986, including the "Hospital at Home" scheme, increased the proportion of patients discharged directly home over an 11-year period from 50% to 86%, reduced transfer rates to other wards from 43% to 9%, and decreased length of stay from 51 to 21 days (15).

In the US, the numbers of rehabilitation facilities and distance from a patient's home have been identified as stronger determinants of where patients received post-acute rehabilitation than individual characteristics (16, 17). A systematic review of 30 randomized and 25 non-randomized studies of hip fracture rehabilitation concluded that clinical pathways providing intensive therapy and early supported discharge were associated with improved functional recovery, whilst less intense post-acute 'skilled nursing facility' rehabilitation was associated with a longer combined length of stay (18).

Study strengths and limitations

This study is the first to combine data from acute and community rehabilitation hospitals to examine the effect of different institutional arrangements for providing rehabilitation care within the NHS. Its strengths come from using interviews to establish a detailed picture of service provision and from using administrative patient-level data to describe the flow of patients between acute and rehabilitation hospitals. The comprehensiveness of HES allowed us to match admissions of the same patient to acute and CRH beds within the NHS.

We excluded patients discharged from Hospital D to one PCT, since nearly a third, coded as transfers to another NHS institution, were missing a subsequent CRH admission record. We re-ran the analysis using more complete data from the previous year, including this PCT, which did not alter conclusions about the relationship between CRH transfers and LOS.

HES do not capture admissions to private hospitals. However, in England, almost all hip fractures are expected to pass through NHS care. Our organisational survey did not identify even occasional use of private residential rehabilitation services. Each of the acute hospitals did have access to a small number of social care funded rehabilitation beds not captured within HES, which could lead to a slight underestimate of CRH bed usage.

We have presented results from simple analyses of the crude rates of transfer and median length of stay across eight patient groups with varying levels of access to community rehabilitation services. We also calculated variation in adjusted transfer rates and correlations between these and adjusted LOS, taking account of age, sex, comorbidity, socio-economic deprivation and rural living, but this did not alter our conclusions (see Supplementary

appendix). However, HES lacks data on some potential confounders such as pre-fracture mobility, and the need for new nursing home placement. Based on NHFD published data, across the four acute hospitals the proportion of patients admitted from a nursing home or residential care was similar (17% to 19%), but the proportion discharged from the acute trust to a nursing home or residential care was more variable (14% to 24%) (19). To what extent delays waiting for new nursing home placements impact on median LOS in unclear, although use of median rather than mean, reduces the influence of outliers. We included the small proportion of patients who were managed without surgery and who died in hospital; but their inclusion or exclusion did not affect our study conclusions.

Finally, our study relates to activity in one geographical area in South West England, and to former PCTs now replaced by Clinical Commissioning Groups (CCGs), and may not be generalisable across the country. On the other hand, the study population had similar demographic characteristics to the national hip fracture population and contained similar between-hospital variation in acute and combined lengths of stay (4); furthermore, the new CCGs in this region mirror the old PCTs, hence we judged our analysis to still be relevant to the 'New NHS'.

Unanswered questions for future research

Our study focused on one English region. The results provide insight into the relationship between availability and use of community rehabilitation services, and hospital length of stay, but the generalisability of the results is limited. It is important that studies are undertaken in other locations to extend our understanding of how different sets of institutional arrangements for providing rehabilitation care affect length of stay, as well as other outcomes. The extent to which financially-pressured hospital management systems drive CRH transfers over the influence of the clinical team is also not known. Given recent NHS reorganization and move to clinical commissioning of services, it will be interesting to see how our findings change over the next few years.

Conclusions and policy implications

Access to post-fracture rehabilitation care varied within a geographical area in South West England. Inequity in access to community rehabilitation services is inconsistent with the government's strongly promoted policy of patient choice, aimed at reducing inequalities in access to healthcare, improving responsiveness and quality of services (20) and reducing the 'postcode lottery' in service provision for older people (21).

Poor access to home-based rehabilitation services is arguably inefficient, as well as inequitable. The highest rate of transfer to community rehabilitation hospitals was observed in one patient group without any access to a home-based community rehabilitation service. In turn, a high rate of transfer to community rehabilitation hospitals was associated with a shorter stay in the acute hospital, but at the expense of a longer combined length of stay.

These findings have relevance to current clinical commissioning groups planning intermediate care services. In 2011/2, the average cost of an excess acute hospital bed day was £264 (22), with a CRH bed £252/day (23). To illustrate, our estimates suggest that reducing CRH transfer rates from 50% to 20% for 20,000 hip fracture patients could save the English NHS around £19 million per year (see Supplementary appendix for details). Balanced against this potential saving would be the costs of home-based rehabilitation care, often required for early hospital discharge, although home-based services have lower costs per service user (2).

Appropriate and equitable commissioning of post-fracture rehabilitation services is required, in collaboration with clinical teams, to ensure fair access that is governed by clinical need and patient choice rather than geography. Providing a range of rehabilitation options could also improve the efficiency of care

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Ethical approval: The study is exempt from UK National Research Ethics Committee approval as it involved analysis of an existing dataset of anonymised data for service evaluation. Approvals for the use of anonymised Hospital Episode Statistics (HES) data were obtained as part of the standard approval process.

Data sharing: No additional data available.

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Table 1 Description of four acute hospital hip fracture services and access to community rehabilitation services, information collected via organisational survey 2011/2012

	Hospital A	Hospital B	Hospital C	Hospital D
Approximate catchment population	300,000	500,000	400,000	500,000
Teaching/DGH	Teaching	DGH	DGH	DGH
Orthogeriatrician input	Liaison	Joint care	Joint care	Joint care
Orthogeriatrican sessions[a]/week	3	7	13	10[b]
No. of PCTs at discharge[c]	3	3	2	4
No. of PCTs with a home-based rehabilitation service	3	3	2	3
No. of CRHs at discharge [c,d]	3	2	7	9

DGH: District General Hospital, PCT: Primary Care Trusts, CRH: Community Rehabilitation Hospital, Joint care: Formal joint care between orthogeriatric and trauma and orthopaedic services.

[a] One session = four hours of either morning or afternoon work. [b] Includes five sessions provided by a specialist trainee. [c] Hospitals may discharge small numbers of patients to other PCTs. [d] Each hospital also had access to a small number of beds in one additional social care funded community rehabilitation facility.

Table 2 Description of characteristics of hip fracture patients treated in four acute hospitals included in analysis, Hospital Episode Statistics (HES) data 1st April 2011 to 29th February 2012

	Hospital A	Hospital B	Hospital C	Hospital D
Number of patients	303	326	348	253
Female, n (%)	220 (72.6)	249 (76.4)	246 (70.7)	191 (75.5)
Age in years, n (%):				
50-59	9 (3.0)	10 (3.1)	13 (3.7)	8 (3.2)
60-69	28 (9.2)	22 (6.8)	28 (8.1)	22 (8.7)
70-79	58 (19.1)	63 (19.3)	72 (20.7)	48 (19.0)
80-89	152 (50.2)	168 (51.5)	165 (47.4)	122 (48.2)
90 and older	56 (18.4)	63 (19.3)	70 (20.1)	53 (21.0)
No. of comorbidities, n (%): [a]				
0	135 (44.6)	156 (47.9)	148 (42.5)	99 (39.1)
1	117 (38.6)	121 (37.1)	142 (40.8)	106 (41.9)
≥2	51 (16.8)	49 (15.0)	58 (16.7)	48 (19.0)
Index of multiple deprivation, n (%):				
1 (least deprived)	62 (20.5)	91 (27.9)	121 (34.8)	61 (24.0)
2	67 (22.1)	55 (16.9)	101 (29.0)	82 (32.4)
3	39 (12.9)	61 (18.7)	60 (17.2)	61 (24.1)
4	76 (25.1)	81 (24.9)	38 (10.9)	44 (17.4)
5 (most deprived)	59 (19.5)	38 (11.6)	28 (8.0)	5 (2.0)
Living in rural area, n (%)	11 (3.6)	15 (4.6)	54 (15.5)	60 (23.7)

[a] Based on comorbidities included in the Royal College of Surgeons (RCS) Charlson Score.

Table 3 Relationship between rate of transfer to community rehabilitation hospitals (CRH) and length of stay (LOS), across eight groups categorised by the combination of acute hospital and Primary Care Trust (PCT)

Group [a]	Acute hospital and PCT	No. of patients	No (%) of patients transferred to CRH	Median acute hospital LOS (days)	Median combined LOS (days) [c]
1	Hospital B, PCT 2	141	3 (2.1)	19	20
2	Hospital B, PCT 3	185	8 (4.3)	19	19
3	Hospital C, PCT 5	137	44 (32.1)	13	17
4	Hospital A, PCT 1[b]	70	23 (32.9)	13	25.5
5	Hospital C, PCT 4	211	80 (37.9)	13	23
6	Hospital D, PCT 5	189	73 (38.6)	14	21
7	Hospital A, PCT 2[b]	233	110 (47.2)	11	23
8	Hospital D, PCT 6	64	35 (54.7)	11	27.5

[a] Group ranked by rate of transfer to the CRH. [b] These represent transfers from the acute hospital to a CRH run by the acute hospital trust. [c] This is the median combined length of stay in the acute hospital and the CRH.

Figure legends

Figure 1 Selection of patients from Hospital Episode Statistics

Figure 2 Relationship between rate of transfer to community rehabilitation hospital (CRH) and median length of stay (LOS) in: a) acute hospital; and b) acute hospital and CRH combined
Each of the eight points on each graph shows the transfer rate to a community rehabilitation hospital (CRH) and median length of stay (LOS) for patient groups categorized by combinations of their acute hospital and Primary Care Trust (also see Table 3). The dashed lines are quadratic fits of LOS to transfer rate, included for illustrative purposes.

Variation in access to community rehabilitation services and length of stay in hospital following a hip fracture: a cross-sectional study

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ABSTRACT

Objectives: To assess variation in access to and use of community rehabilitation services for patients with a hip fracture, and whether this affects length of stay in hospital.

Design: Cross-sectional study using administrative patient-level data from Hospital Episode Statistics (HES) and organisational survey data.

Setting: A regional health economy in South West England served by four acute NHS hospital trusts and six former Primary Care Trusts (PCTs).

Population: 1,230 hip fracture patients treated in an acute hospital between 1st April 2011 and 29th February 2012.

Main outcomes: Information about access to community rehabilitation services for each acute hospital and PCT, reported by organisational survey. Rates of patients transferred from acute hospital to community rehabilitation hospitals (CRH) across eight groups with varying access; determined by acute hospital and PCT. Median lengths of stay in the acute hospital, and in the acute hospital plus CRH combined. Associations between the rate of transfer to a CRH and median lengths of stay assessed using Spearman's rank correlation coefficient (rs).

Results: Access to community rehabilitation services varied, including the number of CRH inpatient beds, formal access criteria and waiting times. In one PCT, no home-based rehabilitation service was available. The percentage of patients transferred to a CRH ranged from 2.1% to 54.7%. A higher transfer rate was associated with a shorter median length of stay in the acute hospital (rs = -0.8; P = 0.01), but a longer median combined length of stay in the acute hospital and CRH (rs = +0.7; P = 0.04).

Conclusion: Within one geographical area, there was wide variation in availability and use of community rehabilitation services for patients discharged from an acute hospital following a hip fracture. Reliance on transfers to community rehabilitation hospitals was associated with a longer length of stay in the NHS.

Study strengths and limitations

- This study is the first to combine data from acute hospitals and community rehabilitation hospitals (CRHs) to examine different institutional arrangements for providing rehabilitation care.
- The comprehensiveness of the Hospital Episode Statistics (HES) allowed us to match admissions of the same patient to acute and community rehabilitation beds.
- Our study relates to activity in one geographical area in South West England and may not be generalisable across the country.
- The HES database does not capture admissions to private hospitals. However, in England, almost all hip fractures are expected to pass through NHS care. Our organisational survey did not identify even occasional use of private residential rehabilitation services.
- Each of the acute hospitals had access to a small number of social care funded rehabilitation beds that are not captured within HES. This could lead to a slight underestimate of use of CRH beds and total institutional length of stay.

What is already known on this topic

- Hip fractures are common among older people and account for significant expenditure in the NHS
- Acute hospital length of stay after hip fracture varies widely, but can be shortened by services providing ongoing rehabilitation either at home or within a community rehabilitation hospital.

What this paper adds

- Within a defined region in South West England, we found marked variation in access to community rehabilitation services following a hip fracture, varying by both acute hospital and PCT.
- Correspondingly, we identified was large variation in rates of transfer from acute hospitals to community rehabilitation hospitals.
- A higher rate of transfer was associated with a shorter length of stay in the acute hospital, but a longer combined length of stay, suggesting reduced efficiency.

Introduction

An important element of ensuring a safe hospital discharge is the provision of appropriate services to support individuals in the community, including ongoing rehabilitation when indicated (1). When provided early, such services can reduce length of stay in the acute hospital; although some frailer patients may benefit from extended inpatient rehabilitation to achieve a discharge home. However, the 2013 National Audit of Intermediate Care highlighted wide variation in the number, location and staffing of rehabilitation services across the country, (2) with no improvement in capacity since the previous year (3). Little is known of the variation in access to community rehabilitation services for specific patient groups, and the impact on length of hospital stay.

Around 60,000 older adults fracture a hip each year in England (4), and the number is projected to increase with our ageing population. Such fractures represent a major trauma for individuals and a significant societal burden, both through direct health service costs (UK estimated £1.8 billion in 2000), and important social sequelae (5). Since its launch in 2007, the National Hip Fracture Database (NHFD) supported by the 'Blue Book', has highlighted the importance of geriatrician-led multidisciplinary rehabilitation (1). In 2012, the National Institute for Clinical Excellence (NICE) issued specific guidance (CMG46) on commissioning high-quality post-acute hip fracture care for up to six weeks following hospital discharge (6).

The 2013 NHFD report revealed wide variation in institutional arrangements for providing rehabilitation care following hip fracture, and wide variation in length of stay following a hip fracture: the average length of stay in NHS hospitals was 22 days, but this figure ranged from 12.9 to 33.5 days, nearly a three-fold variation (4). With its focus on care provided within the acute hospital, the NHFD report was not able to identify external drivers of variation in length of stay, given the complex and heterogeneous provision of rehabilitation care. Ours is the first study to evaluate the impact of variation in community rehabilitation services, provided outside the acute hospital, on length of stays in the acute hospital and in the NHS overall.

We aimed to assess variation in access to and use of community rehabilitation services provided outside the acute hospital within one geographical area in England. First, we conducted an organisational survey to identify variation in access to community rehabilitation services across four NHS acute hospitals and their affiliated former Primary Care Trusts.

Second, we analysed administrative patient-level data from the Hospital Episode Statistics to calculate rates of transfer from acute hospitals to community rehabilitation hospitals across eight patient groups categorised by combinations of their acute hospital and their PCT. Third, we analysed the relationship between rate of transfer and average lengths of stay, in order to evaluate the efficiency of different institutional arrangements for providing rehabilitation care within the NHS.

Methods

Study setting

Our study focused on one defined geographical area in South West England served by four NHS acute hospital trusts. One inner-city teaching hospital (hospital A) and three district general hospitals (hospitals B, C, D) served a combined total catchment population of approximately 1.7 million people. The acute hospitals represent four distinct models of inpatient hip fracture care with access to a range of community rehabilitation services provided by the acute trust or by former Primary Care Trusts (PCT). We defined a community rehabilitation hospital (CRH) as a local NHS institution providing on-site integrated health and social care with specifically *inpatient* access to physiotherapy for the purpose of rehabilitation; this contrasts with home-based rehabilitation and care services provided after discharge from a hospital in a patient's own home.

Organisational survey of orthogeriatricians regarding access to community rehabilitation services

A standardized questionnaire was used to facilitate structured interviews with hospital orthogeriatricians, all conducted by one orthogeriatrician (CLG), collecting retrospective data regarding provision of orthogeriatric and local community rehabilitation services in 2011/2012. Information was collected regarding: the orthogeriatric service model, source PCTs for admissions; CRHs and other residential intermediate care facilities to which patients could be transferred or discharged within each acute trust and PCT; availability of home-based community rehabilitation services within each PCT and access criteria; and ongoing clinical or managerial responsibility for patients following transfer to a CRH. Respondents were also given the opportunity to comment on other system issues relating to access (see supplementary appendix). This survey information was combined with 2011 Census data on PCT catchment populations to crudely estimate numbers of community rehabilitation beds per 10,000 people aged 65 years and over (7).

Hospital Episode Statistics used in statistical analysis

The flow of patients from acute hospitals to CRHs was established using an extract of patient-level data extracted from an anonymised copy of the Hospital Episode Statistics (HES) database. The HES database contains administrative records describing the care of all hip fracture patients admitted to hospitals providing NHS-funded care in England, including acute and community hospitals (8). Patients' diagnoses are coded using ICD-10 (International Classification of Diseases, 10th revision), and procedures are coded using the classification of surgical operations from the UK Office of Population Censuses and Surveys (OPCS), version 4.

We identified patients who had a fractured neck of femur using the ICD-10 disease codes: S72.0 (Fracture of Neck of Femur); S72.1 (Petrochanteric fracture); and S72.2 (Subtrochanteric fracture). An anonymised patient identifier, derived from the patient's NHS number, was used to match admissions of the same patient to different hospitals.

Our sample included 1,230 patients who met the following inclusion criteria: admitted to one of four acute trusts with a fractured neck of femur between 1st April 2011 and 29th February 2012 (11 months used to avoid downward bias of estimates of LOS due to truncation of spells at 30th March 2012); and registered with a general practitioner (GP) in one of the seven PCT areas. A patient's PCT was defined by the address of their registered GP, because this determined formal eligibility for services. For patients who had their discharge destination coded as a transfer from the acute hospital to another NHS provider, we excluded those missing a record for a subsequent admission to a CRH or other NHS hospital. We excluded all patients from one PCT affiliated with Hospital D because a third of CRH records were missing.

Variable definitions: Community rehabilitation hospital and lengths of stay

We defined a transfer to a CRH bed as either: a formal discharge from the NHS acute trust and admission to a community hospital outside the trust; or a transfer within the same acute trust from the acute hospital to another site providing geriatric care, intermediate care or rehabilitation. In order to identify these transfers, we matched admissions of the same patient to different hospitals using the following criteria: the discharge destination code for the acute hospital or else the source/method of admission code for the second hospital indicated a transfer; and the admission to the second hospital was not coded as an emergency admission.

We calculated length of stay (LOS) in the acute hospital as the number of days between the admission date to the acute hospital and the date of discharge from, or transfer out of, the acute hospital. We calculated the combined LOS in the acute hospital and CRH as the number of days between the date of admission to the acute hospital and the final date of discharge, from the CRH if the patient was transferred, or from the acute hospital if the patient was not transferred.

We derived other variables to describe patient characteristics, including: age (as a categorical variable: under 60 years; 60-69 years; 70-79 years; 80-89 years; 90 and over); gender; comorbidity; socio-economic deprivation; and living in a rural area. We used the Royal College of Surgeons of England's modified Charlson Score to calculate a comorbidity score (9). This is based on a number of selected chronic conditions identified using ICD-10 diagnosis codes in HES for the index admission and admissions during the previous year. We used the Index of Multiple Deprivation (IMD) to measure socio-economic deprivation (10). We used the IMD score for a patient's area of residence and then grouped patients into five categories based on the national ranking of local areas. We used the classification of output areas as rural or urban, with a rural area defined as a village, hamlet or isolated dwelling.

Statistical analysis

We calculated the rate of transfer from the acute hospital to CRHs for each of eight patient groups categorised by combinations of their acute hospital and PCT. We categorised the data in this way because it is the combination of acute hospital and PCT that determines patient access to community rehabilitation services. For example, access will depend upon formal and informal institutional arrangements such as: whether the acute hospital is part of a larger organizational unit (acute NHS trust) running its own CRH; agreed eligibility criteria and referral arrangements between providers; proximity of services to a patient's home; and waiting times for CRH beds.

We used the χ^2 test to assess differences in transfer rates between groups. We used Spearman's rank correlation coefficient r_s to measure associations between the transfer rate and: median LOS in the acute hospital; and median LOS in the acute hospital and CRH combined, across the eight groups. We also checked correlations between adjusted measures (see Supplementary Appendix for details). Data were analysed using Stata version 11. Reported P values are two sided.

Results

Acute hospital services

Each hospital admitted between 300 and 400 patients with hip fracture each year. The three district general hospitals provided a model of joint care between orthogeriatric and trauma and orthopaedic services, whilst the teaching hospital provided a liaison model of orthogeriatric care. Timetabled orthogeriatrician input varied, with the fewest clinical sessions being provided within the teaching hospital and between 7 and 13 sessions provided within the district general hospitals (Table 1).

Access to community rehabilitation services

The six PCTs served a population of around half a million older adults (aged ≥ 65 years). Each PCT was served by one or two acute hospitals and had access to between one and three CRHs. The total number of CRH beds per PCT ranged from 18 to 82, and the number of CRH beds available per 10,000 older adults ranged from 4 to 20 (Data Supplement, Table A). Each hospital was located in PCTs served by between two and nine CRHs (Table 1).

Access to CRH beds depended upon the allocation of beds and referral arrangements, not only on the number of CRH beds. One of the acute hospitals (Hospital A) was part of a larger acute trust that ran its own CRH. In one PCT (PCT 1) only patients registered with specific GPs in one town had access to the PCT-run CRH. The two CRHs affiliated with hospital B had very limited availability and long waiting times, with the result that most patients were fit to return home before a CRH bed became available.

All PCTs except for one (PCT 6) offered home-based community rehabilitation services. One PCT (PCT 3) had an early supported discharge program, but this operated strict access criteria including: no cognitive deficit; safe to mobilise with aids; and no over-night care needs.

No acute hospital orthogeriatician retained clinical or managerial responsibilities for ongoing rehabilitation of their patients following transfer to a CRH.

Characteristics of patients sustaining a hip fracture

Out of 1,230 patients included in the sample, just under a third were male, approximately a fifth were aged 90 years or older, and more than half had at least one comorbid condition included in the Charlson score (Table 2). Rural living and socio-economic deprivation varied between acute hospital hip fracture populations. Two of the acute hospitals treated a mix of

patients who lived in deprived and affluent areas, but where only 4% lived in rural areas. In contrast, the other two acute hospitals served more affluent populations, with 15.5% and 23.7% from rural areas respectively.

Variation in rates of transfer to CRH beds

Table 3 displays the transfer rates to CRH beds across eight patient groups according to combinations of their acute hospital and PCT. Rates of transfer ranged from 2.1% to 54.7%, representing substantive and statistically significant variation (P <0.001).

Comparing these figures to the organisational survey findings, the patient groups with the lowest transfer rates were treated in an acute hospital (Hospital B) that reported very poor access to CRH beds for its patients across both its PCTs. The patient group with the highest CRH transfer rate (Hospital D, transferring to PCT 6) occurred in the only PCT without access to a home-based rehabilitation service.

Influence of transfer rate to CRH on length of stay

Median LOS in the acute hospital ranged from 11 to 19 days. Median combined LOS in the acute hospital and CRH ranged from 17 to 27.5 days. A higher rate of CRH transfer was associated with a shorter median LOS in the acute hospital (r_s = -0.8; P = 0.01), but a longer combined LOS (r_s = +0.7; P = 0.04). Whilst there was a clear linear relationship between higher CRH transfer rates and reduced acute hospital LOS, the relationship with combined length of stay was not linear. Only high transfer rates seemed to be associated with a more marked increase in combined LOS (Figure 2).

Adjustment for age, gender, comorbidity, socio-economic deprivation and rural habitation did not change the associations between transfer rates and LOS (Supplementary Appendix).

Discussion

Main findings of this study

In a geographical area of England that covered half a million older adults, we identified considerable variation in access to and use of community rehabilitation services following acute hospitalization for a hip fracture. Across the PCTs, the number of community rehabilitation hospital (CRH) beds available ranged from 4 to 20 beds per 10,000 older adults (aged ≥ 65 years). Access criteria also varied; for example, in one PCT, only patients registered with specific GPs in one town had access to the CRH beds. Rates of transfer from

the acute hospital to a CRH ranged from 2.1% to 54.7% between patient groups with different levels of access to community rehabilitation services.

Variation in transfer rates to CRH beds was in turn associated with differences in median hospital length of stay. A higher rate of CRH transfer was associated with a shorter average length of stay in the acute hospital, but a longer average combined length of stay in the acute hospital and CRH.

Findings in context

From a patient's perspective, the advantages of transfer to a CRH may include being closer to home, family and friends, as well as local community rehabilitation teams; factors potentially of greater importance in geographically remote rural areas (11). This may explain why the two hospitals (C and D) with larger rural populations transferred more patients to CRHs. Balanced against this are possible negative aspects of transfer, such as: delayed rehabilitation progress due to the disruption of a transfer; the need to become familiar with another health care team; and the risk of less intensive rehabilitation in slower-stream units.

In England and Wales, NICE has issued specific guidance regarding commissioning of high-quality hip fracture care for up to 6 weeks following hospital discharge, stating patients should be offered early supported discharge when appropriate (6); a service we found to be available in only one PCT. NICE also state that continued rehabilitation in a CRH should only be considered if the hip fracture clinical team retains managerial responsibility, ensuring that CRHs are not used as a substitute for effective acute hospital rehabilitation. However, in our study, no hospital orthogeriatrician retained clinical or managerial responsibility for ongoing rehabilitation following transfer from the acute hospital. As transfers often involve moves between organizations and hence lines of accountability and employment, this is perhaps not surprising. The increasing development of community geriatricians may offer some scope to improve continuing of care (12).

What is already known on this topic?

There is some evidence from the UK on the relative efficiency and effectiveness of different institutional arrangements for providing post-fracture rehabilitation care. A study of eight hospitals in East Anglia found patients treated in hospitals with a policy of transferring to other wards prior to discharge had a longer average length of stay (13). A comparison of two hospitals found that routine transfer of patients to a Geriatric Orthopaedic Rehabilitation Unit in one hospital was associated with a shorter average stay on the orthopaedic ward but a

longer hospital stay (14). The introduction of the Peterborough hip fracture service in 1986, including the "Hospital at Home" scheme, increased the proportion of patients discharged directly home over an 11-year period from 50% to 86%, reduced transfer rates to other wards from 43% to 9%, and decreased length of stay from 51 to 21 days (15).

In the US, the numbers of rehabilitation facilities and distance from a patient's home have been identified as stronger determinants of where patients received post-acute rehabilitation than individual characteristics (16, 17). A systematic review of 30 randomized and 25 non-randomized studies of hip fracture rehabilitation concluded that clinical pathways providing intensive therapy and early supported discharge were associated with improved functional recovery, whilst less intense post-acute 'skilled nursing facility' rehabilitation was associated with a longer combined length of stay (18).

Study strengths and limitations

This study is the first to combine data from acute and community rehabilitation hospitals to examine the effect of different institutional arrangements for providing rehabilitation care within the NHS. Its strengths come from using interviews to establish a detailed picture of service provision and from using administrative patient-level data to describe the flow of patients between acute and rehabilitation hospitals. The comprehensiveness of HES allowed us to match admissions of the same patient to acute and CRH beds within the NHS.

We excluded patients discharged from Hospital D to one PCT, since nearly a third, coded as transfers to another NHS institution, were missing a subsequent CRH admission record. We re-ran the analysis using more complete data from the previous year, including this PCT, which did not alter conclusions about the relationship between CRH transfers and LOS.

HES do not capture admissions to private hospitals. However, in England, almost all hip fractures are expected to pass through NHS care. Our organisational survey did not identify even occasional use of private residential rehabilitation services. Each of the acute hospitals did have access to a small number of social care funded rehabilitation beds not captured within HES, which could lead to a slight underestimate of CRH bed usage.

We have presented results from simple analyses of the crude rates of transfer and median length of stay across eight patient groups with varying levels of access to community rehabilitation services. We also calculated variation in adjusted transfer rates and correlations between these and adjusted LOS, taking account of age, sex, comorbidity, socio-economic deprivation and rural living, but this did not alter our conclusions (see Supplementary

appendix). However, HES lacks data on some potential confounders such as pre-fracture mobility, and the need for new nursing home placement. Based on NHFD published data, across the four acute hospitals the proportion of patients admitted from a nursing home or residential care was similar (17% to 19%), but the proportion discharged from the acute trust to a nursing home or residential care was more variable (14% to 24%) (19). To what extent delays waiting for new nursing home placements impact on median LOS in unclear, although use of median rather than mean, reduces the influence of outliers. We included the small proportion of patients who were managed without surgery and who died in hospital; but their inclusion or exclusion did not affect our study conclusions.

Finally, our study relates to activity in one geographical area in South West England, and to former PCTs now replaced by Clinical Commissioning Groups (CCGs), and may not be generalisable across the country. On the other hand, the study population had similar demographic characteristics to the national hip fracture population and contained similar between-hospital variation in acute and combined lengths of stay (4); furthermore, the new CCGs in this region mirror the old PCTs, hence we judged our analysis to still be relevant to the 'New NHS'.

Unanswered questions for future research

Our study focused on one English region. The results provide insight into the relationship between availability and use of community rehabilitation services, and hospital length of stay, but the generalisability of the results is limited. It is important that studies are undertaken in other locations to extend our understanding of how different sets of institutional arrangements for providing rehabilitation care affect length of stay, as well as other outcomes. The extent to which financially-pressured hospital management systems drive CRH transfers over the influence of the clinical team is also not known. Given recent NHS reorganization and move to clinical commissioning of services, it will be interesting to see how our findings change over the next few years.

Conclusions and policy implications

Access to post-fracture rehabilitation care varied within a geographical area in South West England. Inequity in access to community rehabilitation services is inconsistent with the government's strongly promoted policy of patient choice, aimed at reducing inequalities in access to healthcare, improving responsiveness and quality of services (20) and reducing the 'postcode lottery' in service provision for older people (21).

Poor access to home-based rehabilitation services is arguably inefficient, as well as inequitable. The highest rate of transfer to community rehabilitation hospitals was observed in one patient group without any access to a home-based community rehabilitation service. In turn, a high rate of transfer to community rehabilitation hospitals was associated with a shorter stay in the acute hospital, but at the expense of a longer combined length of stay.

These findings have relevance to current clinical commissioning groups planning intermediate care services. In 2011/2, the average cost of an excess acute hospital bed day was £264 (22), with a CRH bed £252/day (23). To illustrate, our estimates suggest that reducing CRH transfer rates from 50% to 20% for 20,000 hip fracture patients could save the English NHS around £19 million per year (see Supplementary appendix for details). Balanced against this potential saving would be the costs of home-based rehabilitation care, often required for early hospital discharge, although home-based services have lower costs per service user (2).

Appropriate and equitable commissioning of post-fracture rehabilitation services is required, in collaboration with clinical teams, to ensure fair access that is governed by clinical need and patient choice rather than geography. Providing a range of rehabilitation options could also improve the efficiency of care.

Figure legends

Figure 1 Selection of patients from Hospital Episode Statistics

Figure 2 Relationship between rate of transfer to community rehabilitation hospital (CRH) and median length of stay (LOS) in: a) acute hospital; and b) acute hospital and CRH combined

Each of the eight points on each graph shows the transfer rate to a community rehabilitation hospital (CRH) and median length of stay (LOS) for patient groups categorized by combinations of their acute hospital and Primary Care Trust (also see Table 3). The dashed lines are quadratic fits of LOS to transfer rate, included for illustrative purposes.

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Contributorship statement: JN and CLG conceived and designed the study and wrote the manuscript. CLG carried out the organisational survey; KH, RB provided organisational data. JN performed the statistical analyses. JN, KH, RB, DC and CLG all commented on, revised sequential drafts and approved the final manuscript for publication. JN is guarantor.

Competing interests: All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: no support from any organisation for the submitted work; JN is funded by a NIHR Post Doctoral Fellowship (PDF-2013-06-078); CLG is funded by Arthritis Research UK through a Clinician Scientist Fellowship (grant ref 20000); no other relationships or activities that could appear to have influenced the submitted work.

Transparency declaration: The lead author (JN) affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned have been explained.

Ethical approval: The study is exempt from UK National Research Ethics Committee approval as it involved analysis of an existing dataset of anonymised data for service evaluation. Approvals for the use of anonymised Hospital Episode Statistics (HES) data were obtained as part of the standard approval process.

Data sharing: No additional data available.

Table 1 Description of four acute hospital hip fracture services and access to community rehabilitation services, information collected via organisational survey 2011/2012

	Hospital A	Hospital B	Hospital C	Hospital D
Approximate catchment population	300,000	500,000	400,000	500,000
Teaching/DGH	Teaching	DGH	DGH	DGH
Orthogeriatrician input	Liaison	Joint care	Joint care	Joint care
Orthogeriatrican sessions[a]/week	3	7	13	10[b]
No. of PCTs at discharge[c]	3	3	2	4
No. of PCTs with a home-based rehabilitation service	3	3	2	3
No. of CRHs at discharge [c,d]	3	2	7	9

DGH: District General Hospital, PCT: Primary Care Trusts, CRH: Community Rehabilitation Hospital, Joint care: Formal joint care between orthogeriatric and trauma and orthopaedic services.

[a] One session = four hours of either morning or afternoon work. [b] Includes five sessions provided by a specialist trainee. [c] Hospitals may discharge small numbers of patients to other PCTs. [d] Each hospital also had access to a small number of beds in one additional social care funded community rehabilitation facility.

Table 2 Description of characteristics of hip fracture patients treated in four acute hospitals included in analysis, Hospital Episode Statistics (HES) data 1st April 2011 to 29th February 2012

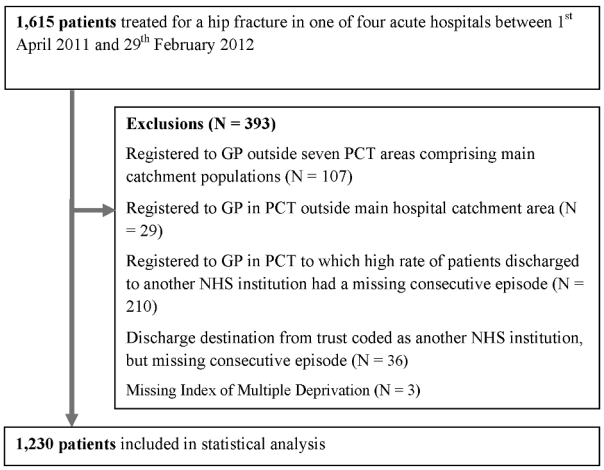
	Hospital A	Hospital B	Hospital C	Hospital D
Number of patients	303	326	348	253
Female, n (%)	220 (72.6)	249 (76.4)	246 (70.7)	191 (75.5)
Age in years, n (%):				
50-59	9 (3.0)	10 (3.1)	13 (3.7)	8 (3.2)
60-69	28 (9.2)	22 (6.8)	28 (8.1)	22 (8.7)
70-79	58 (19.1)	63 (19.3)	72 (20.7)	48 (19.0)
80-89	152 (50.2)	168 (51.5)	165 (47.4)	122 (48.2)
90 and older	56 (18.4)	63 (19.3)	70 (20.1)	53 (21.0)
No. of comorbidities, n (%): [a]				
0	135 (44.6)	156 (47.9)	148 (42.5)	99 (39.1)
1	117 (38.6)	121 (37.1)	142 (40.8)	106 (41.9)
≥2	51 (16.8)	49 (15.0)	58 (16.7)	48 (19.0)
Index of multiple deprivation, n (%):				
1 (least deprived)	62 (20.5)	91 (27.9)	121 (34.8)	61 (24.0)
2	67 (22.1)	55 (16.9)	101 (29.0)	82 (32.4)
3	39 (12.9)	61 (18.7)	60 (17.2)	61 (24.1)
4	76 (25.1)	81 (24.9)	38 (10.9)	44 (17.4)
5 (most deprived)	59 (19.5)	38 (11.6)	28 (8.0)	5 (2.0)
Living in rural area, n (%)	11 (3.6)	15 (4.6)	54 (15.5)	60 (23.7)

[a] Based on comorbidities included in the Royal College of Surgeons (RCS) Charlson Score.

Table 3 Relationship between rate of transfer to community rehabilitation hospitals (CRH) and length of stay (LOS), across eight groups categorised by the combination of acute hospital and Primary Care Trust (PCT)

Group [a]	Acute hospital and PCT	No. of patients	No (%) of patients transferred to CRH	Median acute hospital LOS (days)	Median combined LOS (days) [c]
1	Hospital B, PCT 2	141	3 (2.1)	19	20
2	Hospital B, PCT 3	185	8 (4.3)	19	19
3	Hospital C, PCT 5	137	44 (32.1)	13	17
4	Hospital A, PCT 1[b]	70	23 (32.9)	13	25.5
5	Hospital C, PCT 4	211	80 (37.9)	13	23
6	Hospital D, PCT 5	189	73 (38.6)	14	21
7	Hospital A, PCT 2[b]	233	110 (47.2)	11	23
8	Hospital D, PCT 6	64	35 (54.7)	11	27.5

[a] Group ranked by rate of transfer to the CRH. [b] These represent transfers from the acute hospital to a CRH run by the acute hospital trust. [c] This is the median combined length of stay in the acute hospital and the CRH.



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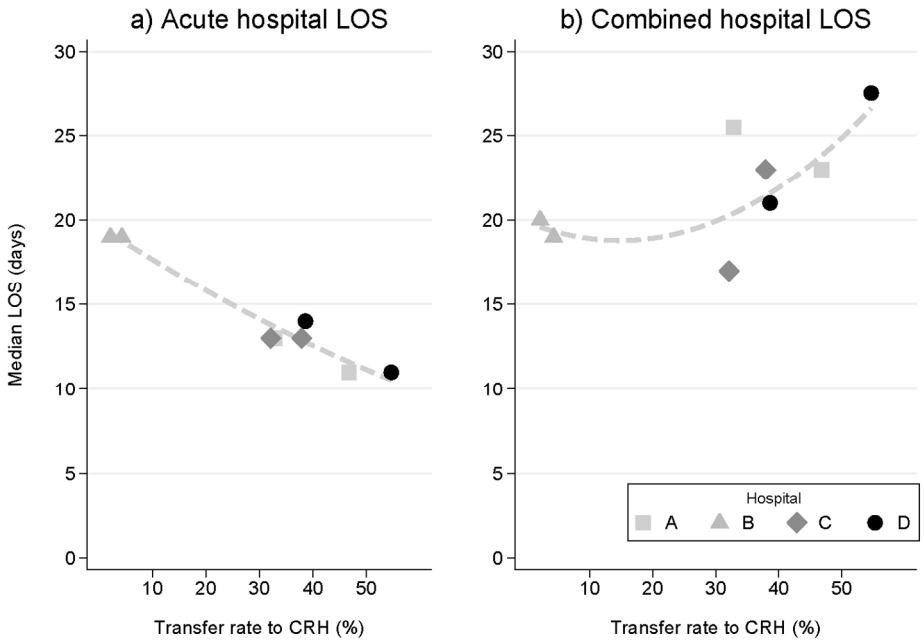

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Orthogeriatrician survey: Structured questionnaire regarding access to community rehabilitation services following hip fracture in 2011-12

Hospital name:……

Consultant name: …… Date: ……/…../…….

Regarding the financial year April 2011 – March 2012

1. What best described your orthogeriatric (OG) model of care during this period:
   - ☐ No formal OG input for patients with #NOF
   - ☐ Liaison OG input for patients with #NOF
   - ☐ Formal joint care of patients with #NOF between OG and T&O

2. What was the average number of consultant PAs spent looking after patients with #NOF each week?

3. Did one of your geriatric registrars have a timetabled commitment to orthogeriatrics during this period? Yes / No If yes how many times per week?

4. Other than consultants and trainee registrars, did you have any other **medical** doctors providing OG input to patients with #NOF? Yes / No
   If yes, please give details:

5. Please list the community hospitals / residential intermediate care facilities to which your trust discharges patients and their corresponding PCT:

Name of community hospital / residential intermediate care facility	Name of PCT

6. Do you retain ongoing clinical/managerial responsibility for rehabilitation in the community hospitals to which you discharge patients?

   Yes / No If yes please give details:

7. Please list the PCTs from which your trust admits patients and for each PCT please list all the community / intermediate care services available (e.g. re-ablement services, community physiotherapy)

Name of PCT	Details regarding community / intermediate care services

8. Please describe any early support discharge programs which run (and state PCT)

   ……
   ……
   ……

9. Are there any further details you wish to add, e.g. variation in access to intermediate care services?

   ……
   ……
   ……
   ……
   ……

	Item No	Recommendation
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract Cross-sectional study (Title - Page 1)
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found Abstract - Page 2
Introduction		
Background/ rationale	2	Explain the scientific background and rationale for the investigation being reported Pages 3-4
Objectives	3	State specific objectives, including any prespecified hypotheses Page 4
Methods		
Study design	4	Present key elements of study design early in the paper Pages 5-6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection Pages 5- 6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants Page 5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable Page 6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group Pages 6-7

Bias	9	Describe any efforts to address potential sources of bias Page 6 and Pages 11-12
Study size	10	Explain how the study size was arrived at Page 5 and Figure 1
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why Page 6
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding Pages 6-7
		(*b*) Describe any methods used to examine subgroups and interactions None undertaken
		(*c*) Explain how missing data were addressed Pages 11-12
		(*d*) If applicable, describe analytical methods taking account of sampling strategy N/A
		(*e*) Describe any sensitivity analyses Pages 11-12
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed Figure 1
		(b) Give reasons for non-participation at each stage N/A
		(c) Consider use of a flow diagram Figure 1

Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders Page 8
		(b) Indicate number of participants with missing data for each variable of interest Figure 1 and Table 1
Outcome data	15*	Report numbers of outcome events or summary measures Tables 2 and 4
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included Tables 2 and 4
		(*b*) Report category boundaries when continuous variables were categorised Table 3
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses N/A
Discussion		
Key results	18	Summarise key results with reference to study objectives Page 10
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias Pages 11-12
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence Pages 10-14
Generalisability	21	Discuss the generalisability (external validity) of the study results Pages 11 and 13
Other information		

Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based Page 15